

Application No. 09/707,624

### IN THE CLAIMS

1. (Presently Amended) A method for inserting a target image into an image stream of a real site taken by a camera, the method comprising:

receiving a stream of original images taken by a camera of a real, three-dimensional site;

for each original image in the image stream,

identifying a background area within the original image from at least one target area in which a target image will be inserted;

rendering, for each at least one target area, a target image based on at least a predefined three-dimensional model of the at least one target area within the site and the camera's position and pointing direction, wherein the target area is comprised of a virtual surface that does not exist within the site;

identifying occlusions within the at least one target area of the original image; and

combining the background of the original image, the at least one target image, and the image of the occlusions into an output image.

2. (Original) The method of claim 1, wherein identifying a background area within the original image includes identifying at least one target area within the image based on a predefined model of selected surfaces of the site and the camera's position and pointing direction.

3. (Original) The method of claim 2, wherein identifying at least one target area within the image comprises:

receiving camera parameters, the camera parameters including parameters indicating the pointing direction of the camera;

rendering the predefined model from the camera's position, based on the camera parameters; and

generating from the rendering a mask for defining the target area within the image.

4. (Original) The method of claim 3, wherein the camera parameters included parameters indicating the camera's position within the site.

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5. (Original) The method of claim 3, wherein the camera's position is predefined within the model.

6. (Original) The method of claim 1, wherein rendering, for at least one target area, a target image comprises:

receiving camera parameters, the camera parameters including parameters indicating the pointing direction of the camera; and

rendering the predefined model based at least in part on the camera parameters.

7. (Original) The method of claim 6, wherein the camera's position is predefined within the model.

8. (Original) The method of claim 6, wherein the camera parameters includes parameters indicating the camera's position within the site.

9. (Original) The method of claim 8 wherein the camera parameters are encoded onto a video signal generated by the camera.

10. (Original) The method of claim 1 wherein identifying occlusions within the image of the target area includes:

rendering the predefined model of the site with a reference image inserted in each of the at least one target areas; and

comparing the reference image to the target area within original image.

11. (Original) The method of claim 1 further including encoding the output image and camera parameters onto an output video signal, the camera parameters including parameters indicating the pointing direction of the camera.

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12. (Presently amended) An apparatus for inserting a target image into video of a real site taken by a camera, the apparatus comprising:

a model renderer for generating, a synthetic image based on a predefined three-dimensional reference model of a target area within a site from a known position of a camera, the target area including a virtual surface that does not exist within the site, the synthetic image having a target image inserted in the target area;

an image separator for masking from a video image contained within a frame of a video signal generated by the camera, the target area to create a masked background image; and

an image combiner for combining the masked background image with the target image.

13. (Original) The apparatus of claim 12 further comprising:

a second model renderer for generating a second synthetic image based on the predefined reference model of the site, the second synthetic image having a reference image inserted into the target area; and

an occlusion separator for comparing the reference image of the second synthetic image to the target area of the video image and generating an image of occlusions within the target area of the video image;

wherein the combiner further combines the image of the occlusions with the masked background image and the target image.

14. (Presently Amended) A method for inserting a target image into an image stream of a real site taken by a camera, the method comprising:

receiving a stream of original images taken by a camera of a real site;

for each original image in the image stream:

identifying a background area within the original image from at least one target area in which a target image will be inserted by identifying at least one target area within the image based on a predefined model of selected surfaces of the site and the camera's position and pointing direction, the target area including a virtual surface that does not exist within the site, wherein identifying at least one target area within the image includes:

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receiving camera parameters, the camera parameters including parameters indicating the pointing direction of the camera;

rendering the predefined model from the camera's position, based on the camera parameters; and

generating from the rendering a mask for defining the target area within the image;

rendering, for each at least one target area, a target image based on at least a predefined three-dimensional model of the at least one target area within the site and the camera's position and pointing direction, the camera's position being predefined within the model, wherein rendering includes receiving camera parameters, the camera parameters including parameters indicating the pointing direction of the camera, and rendering the predefined model based at least in part on the camera parameters;

identifying occlusions within the at least one target area of the original image;

combining the background of the original image, the at least one target image, and the image of the occlusions into an output image.

15. (Previously added) The method of claim 14 wherein identifying occlusions within the image of the target area includes:

rendering the predefined model of the site with a reference image inserted in each of the at least one target areas; and

comparing the reference image to the target area within original image.

16. (Previously added) The method of claim 14 further including encoding the output image and camera parameters onto an output video signal, the camera parameters including parameters indicating the pointing direction of the camera.

17. (New) A method for inserting a target image into an image stream of a real site taken by a camera, the method comprising:

receiving a stream of original images taken by a camera of a real site;

for each original image in the image stream,

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identifying a background area within the original image from at least one target area in which a target image will be inserted;

rendering, for each at least one target area, a target image based on at least a predefined three-dimensional model of the at least one target area within the site and the camera's position and pointing direction, the three-dimensional model being of less than the entire site;

identifying occlusions within the at least one target area of the original image; and

combining the background of the original image, the at least one target image, and the image of the occlusions into an output image.

18. (New) The method of claim 17, wherein identifying a background area within the original image includes identifying at least one target area within the image based on a predefined model of selected surfaces of the site and the camera's position and pointing direction.

19. (New) The method of claim 18, wherein identifying at least one target area within the image comprises:

receiving camera parameters, the camera parameters including parameters indicating the pointing direction of the camera;

rendering the predefined model from the camera's position, based on the camera parameters; and

generating from the rendering a mask or defining the target area within the image.

20. (New) The method of claim 19, wherein the camera parameters included parameters indicating the camera's position within the site.

21. (New) The method of claim 19, wherein the camera's position is predefined within the model.

22. (New) The method of claim 17, wherein rendering, for at least one target area, a target image comprises:

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receiving camera parameters, the camera parameters including parameters indicating the pointing direction of the camera; and

rendering the predefined model based at least in part on the camera parameters.

23. (New) The method of claim 22, wherein the camera's position is predefined within the model.

24. (New) The method of claim 22, wherein the camera parameters includes parameters indicating the camera's position within the site.

25. (New) The method of claim 24 wherein the camera parameters are encoded onto a video signal generated by the camera.

26. (New) The method of claim 17 wherein identifying occlusions within the image of the target area includes:

rendering the predefined model of the site with a reference image inserted in each of the at least one target areas; and

comparing the reference image to the target area within original image.

27. (New) The method of claim 17 further including encoding the output image and camera parameters onto an output video signal, the camera parameters including parameters indicating the pointing direction of the camera.

28. (New) An apparatus for inserting a target image into video of a real site taken by a camera, the apparatus comprising:

a model renderer for generating, a synthetic image based on a predefined three-dimensional reference model including a target area within a site from a known position of a camera, the three-dimensional model being of less than the entire site, the synthetic image having a target image inserted in the target area;

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an image separator for masking from a video image contained within a frame of a video signal generated by the camera, the target area to create a masked background image; and  
an image combiner for combining the masked background image with the target image.

29. (New) The apparatus of claim 28 further comprising:

a second model renderer for generating a second synthetic image based on the predefined reference model of the site, the second synthetic image having a reference image inscribed into the target area; and

an occlusion separator for comparing the reference image of the second synthetic image to the target area of the video image and generating an image of occlusions within the target area of the video image;

wherein the combiner further combines the image of the occlusions with the masked background image and the target image.